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SPACE SHUTTLE/ FOOD SYSTEM STUDY

FINAL REPORT

INTERFACE CONTROL DOCUMENT

CONTRACT NAS 9-13138

MODIFICATIONS 3S, 4C and 5S

prepared for

NATIONAL AERONAUTICS and SPACE ADMINISTRATION
Manned Spacecraft Center
Houston, Texas 77058

Contract NAS9-13138

1974

Prepared by

THE PILLSBURY CO.

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1.0 SCOPE

The galley water system supports the preparation of rehydratable food and beverages for crew consumption during shuttle orbiter missions.

The galley electrical system provides electrical power to the oven and water heater for preparation and temperature control of those hot foods and beverages required for space shuttle orbiter operational missions. The electrical system also provides for telemetry signal detection and transmittal.

The galley structure supports the food storage and preparation equipment. It provides that physical connection necessary to maintain a controlled spatial configuration and assure fault-free operation of that equipment during mission meal preparations. The attachment between the galley and the orbiter provides a means of transferring those loads, induced by the accelerations encountered, into the orbiter structure.

This document establishes the functional, physical and performance interface requirements between the space shuttle orbiter and the galley water system, the orbiter and the galley electrical system, and the orbiter and the galley structural system. It is intended to control the configuration and design of the applicable interfacing items to maintain compatibility between co-functioning and physically mating items and to assure those performance criteria that are dependent upon the interfacing items.

2.0 APPLICABLE DOCUMENTS

2.1 Government Documents

The following documents of the exact issue shown form a part of this document to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this document, the contents of this document shall be considered a superseding requirement.

SPECIFICATIONS:

Military

MIL-B-5087, Amend 2	Bonding, Electrical and Lightning Protection, for Aerospace Systems

National Aeronautics and Space Administration/Johnson Space Center (NASA/JSC)

JSC-09070	End Item Specification, Part I, Performance Requirements For the Space Shuttle Galley
(TBD)	Galley Installation Procedure
MIL-STD-461A	Electromagnetic Interference Characteristics for Equipment

National Aeronautics and Space Administration/Johnson Space Center (NASA/JSC)

SE-S-0073A	Specification, Space Shuttle Fluid, Procurement and Use of
SD-W-0020	Potable Water Specification

National Aeronautics and Space Administration/Johnson Space Center (NASA/JSC)

SL-E-0002 June 4, 1973	Specification, Electromagnetic Compatibility Requirements, Systems for the Space Shuttle Program

2.1 Government Documents (cont'd)

(TBD)	Specification, Galley Food Management
(TBD)	Procedure, Pre-Flight/Installation, Galley Operation

National Aeronautics and Space Administration/Marshall Space Flight Center

40M39569	Connectors, Electrical, Miniature Circular, Environment Resisting, 200°C., Specification For

Drawings

National Aeronautics and Space Administration/Johnson Space Center (NASA/JSC)

(TBD)	Galley Protective Device
(TBD)	Galley Envelope Drawing

2.2 Non-Government Documents

The following documents of the exact issue shown form a part of this document to the extent specified herein.

Specifications

Rockwell International (TBD)	Equipment volume shape control, cabin ingress-egress

Contractor

MF0004-002	Electrical Design Requirements for Electrical Equipment Utilized with the Space Shuttle Vehicle
MF0004-006	Instrumentation Requirements for Suppliers and Subcontractors for the Space Shuttle Program

Drawings

Rockwell International VC70-003208	Galley Volume Allocation Drawing

2.2 Non-Government Documents - Drawings (cont'd)

(TBD)	Quick Disconnect Coupling, Connector
(TBD)	Quick Disconnect Coupling, Fitting

3.0 REQUIREMENTS

3.1 Functional

3.1.1 Galley Water System

The shuttle orbiter shall supply two constant sources of potable water, ambient and chilled to the galley water system.

3.1.1.1 Flow

Both ambient and chilled water sources shall be supplied at a minimum flow of 60#/hr. The demand for both water sources will be intermittent and is defined under 3.3.1.

3.1.1.2 Temperature

Ambient water shall be supplied at a temperature of 55-120°F. Chilled Water shall be supplied at a temperature of 45-55°F. An allowance will be made for that initial volume of water between the interfacing coupling and the chiller which would tend to be warmed to ambient temperature when the chilled water system is not operated. In order to minimize this condition, that volume of water shall be held to 25cc maximum.

3.1.1.3 Pressure

Pressure of both water sources at the flow requirements per 3.1.1.1 shall be 10^{+7}_{-2} psig.

3.1.1.4 Water Quality

The quality of both the ambient and chilled water supplies to the galley shall meet the standards of SE-S-0073 and SD-W-0020. In addition, the volume of any undissolved gas entrained in the water supplied shall not exceed 0.1% of the water volume at 98.6°F. (37°C.).

3.1.2 Galley Electrical System

The shuttle orbiter electrical system shall be in accordance with MF0004-002 and shall supply two sources of power to the shuttle/galley interface; 115 V AC, 400 Hz, 3 phase, 4 wire wye connected, structure ground; and 28 V DC 2 wire, structure ground.

3.1.2.1 Characteristics of AC Power

Characteristics of the AC power source shall meet the requirements of the shuttle orbiter Inverter AC power as defined in MF0004-002, paragraph 3.2.4.

3.1.2.2 Characteristics of DC Power

Characteristics of the DC power source shall meet the requirements of the shuttle orbiter Main DC power as defined in MF004-002, paragraph 3.2.1.

3.1.2.3 Grounding System

The shuttle vehicle structure will be the reference ground for the neutral of the AC power subsystem and the negative of the DC power subsystem in accordance with MF0004-002, paragraph 3.2.5. All case joints and surface to vehicle supporting structure shall be

3.1.2.3 Grounding System (cont'd)

electrically conductive per MIL-B-5087, Class R, two and one half milliohms resistance or less. A conducting plane may be used to simulate vehicle structure for the purpose of measuring installation bond resistance.

3.1.2.4 Electromagnetic Compatibility

The tests, CE01, CE03, RE02 and TT01 for Class II B equipment, Table II of MIL-STD-461, as amended by SL-E-0002, shall be performed. Interference shall be within the limits allowed by these tests. Supporting EMC analysis, if acceptable, may be used to reduce the extent of required EMC testing.

3.1.2.5 Telemetry Signals

The galley electrical system shall provide the devices and wiring to detect and transmit the required telemetry data as described in 3.1.2.5.1. The orbiter electrical system shall provide the excitation required to the detecting devices. The general requirements for the telemetry subsystem shall be in accordance with MF0004-006.

3.1.2.5.1 Telemetry Data

The data required to be detected and transmitted shall be designated as the following instrumentation data item number:

a) V62T0701A Food Oven Temperature

b) V62T0704A Hot Water Temperature

3.1.2.5.1 Telemetry Data (cont'd)

c) V62S0702E Food Oven On

d) V62S0705E Potable Hot Water Heater

3.1.3 Galley Structural System

3.1.3.1 Structural Attachment

The orbiter structure shall provide (TBD) attaching points, with the galley structure capable of transferring those loads specified in 3.3.3.1.1 induced by the accelerations upon the galley mass.

3.1.3.2 Structural Deflection

The structural connection (galley to orbiter) shall not introduce loads, due to orbiter deflection, into the galley structure - nor shall any such deflection cause a subsequent degradation of the operable equipment or functioning of the galley subsystems due to deflection of the galley structure. The galley structural connection shall be arranged so as not to restrain the orbiter structure from its normal deflection under load, as would be the case without the galley installed. Under all conditions of orbiter flexure, a minimum clearance of 1.0 inch shall be maintained between the galley envelope and the orbiter structure except where attached or other controlled mätings are guaranteed.

3.1.3.3 Envelope

The total galley volume shall be contained within the volume defined by (TBD Drawing #) Galley Envelope Drawing.

3.1.3.4. Galley Removal/Installation

The shape of the galley, or subassemblies making up the galley, shall be in accordance with equipment volume/shape control, cabin ingress-egress (TBD Document #) and within the limitations of 3.1.3.3 to allow ingress and egress through the hatch and maneuverability within the orbiter mid-deck compartment to its installed position. The configuration of the immediate surroundings, and the location, of the installed galley is shown in VC70-003208.

3.2 Physical

3.2.1 Galley Water System

3.2.1.1 Coupling Type

Both ambient and chilled water sources shall be connected to the galley water system as depicted in Figure 1. Points X and Y represent the interface at the coupling center lines. (See Note 6.1.1)

3.2.1.1.1 Self Sealing

The galley water system coupling and the shuttle orbiter coupling shall automatically seal upon disengagement, preventing water leakage from the galley water system and the shuttle orbiter water system.

3.2.1.1.2 Leakage

There shall be no leakage allowed when the couplings are connected and the system is under rated pressure and flow. When being disconnected, a maximum of (TBD) water is allowed to leak out.

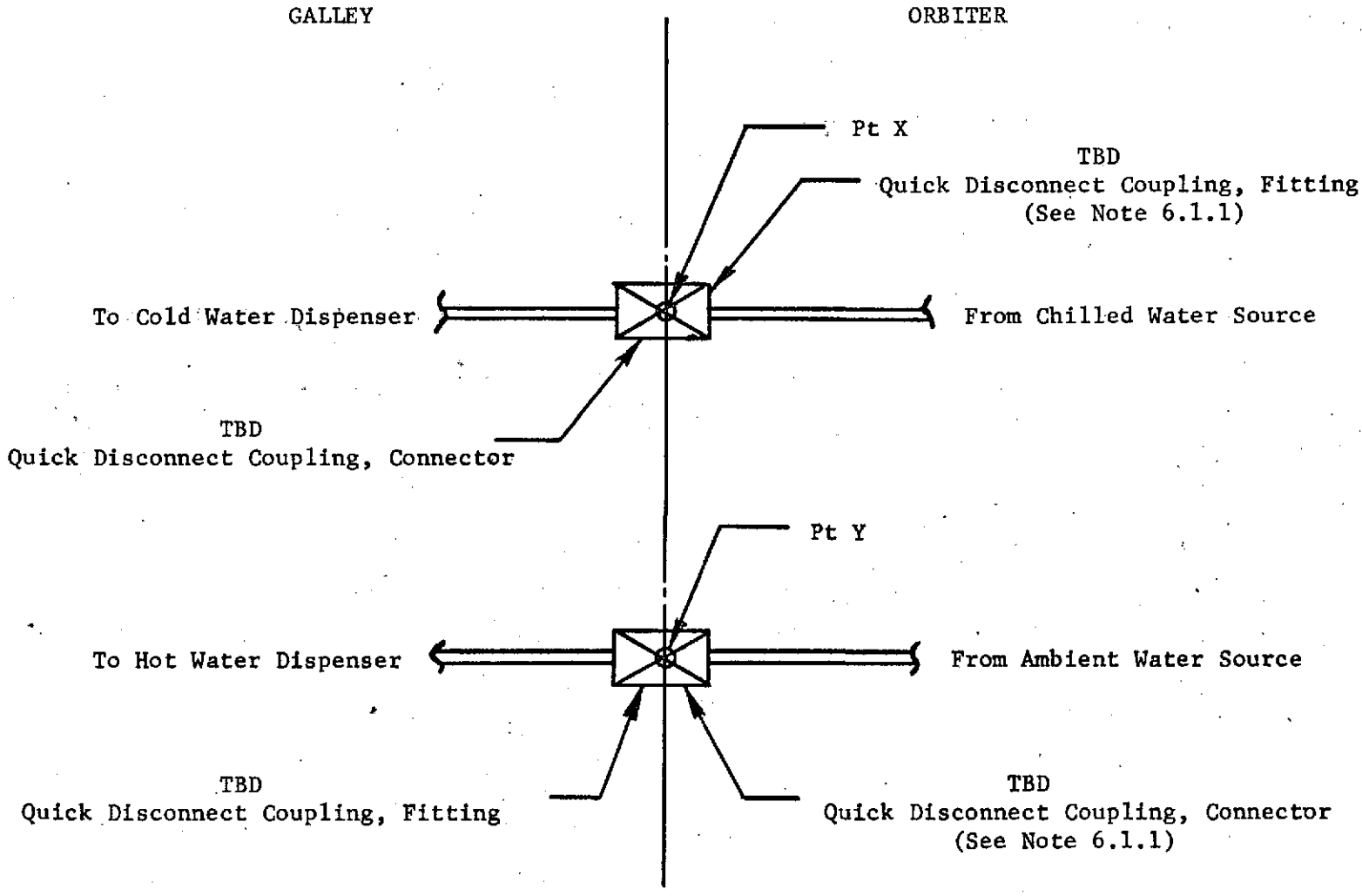


Figure 1. Galley Water System Connection to Shuttle Orbiter Source

3.2.1.1.3 Maintenance

There shall be no special tools required for assembly or disengagement of the water coupling.

3.2.1.2 Coupling Caps

Provision shall be made for each coupling to accept caps when disengaged.

3.2.1.3 Location

The ambient and chilled water system couplings for the galley and orbiter shall be located as shown in Figure 2 relative to the galley. Points X and Y are defined in 3.2.1.1 and Figure 1.

3.2.1.4 Provision for Misalignment

The couplings and/or tubing shall be mounted to their respective structure in such a manner so as to provide positive alignment of one coupling to the other without incurring undue residual stresses in the coupling and/or tubing.

3.2.1.5 Coupling Arrangement

The couplings shall be arranged or configured such as to make impossible the connecting of the ambient water source to the chilled water system and vice versa.

3.2.1.6 Coupling Retention

The coupling connection shall be positively locked to prevent loosening during service.

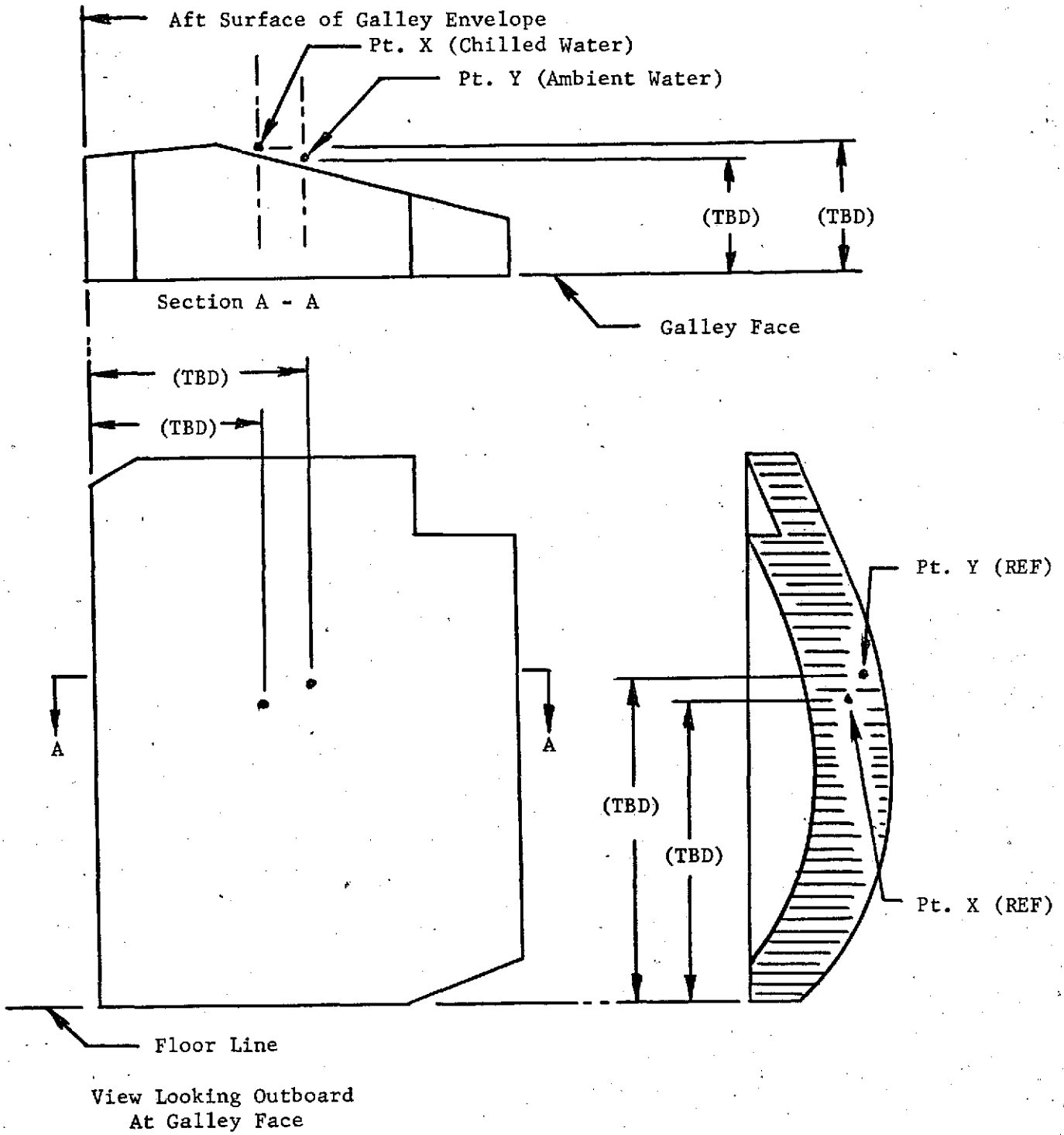


Figure 2. Location of Water System Coupling

3.2.1.7 Interchangeability

The individual coupling shall be interchangeable such that replacement of one will not necessitate changing its mating coupling.

3.2.1.8 Electrical Bonding

Both orbiter and galley connectors shall have a mechanically secure connection to their respective structure, each of which shall have an electrical bonding resistance less than 1 ohm when dry, in accordance with MIL-B-5087, Class S.

3.2.1.9 Accessibility to Coupling

Accessibility shall be provided to connect and disconnect the coupling without the use of universal joints, angular extensions, handle extensions, or combinations thereof, in conjunction with torque tools while the galley is in the installed position within the orbiter. While being connected or disconnected, a clear view shall also be provided of the coupling.

3.2.1.10 Shut-off Valve

A shut-off valve shall be provided upstream of the coupling.

3.2.1.11 Bleeding Provisions

Bleeding of any entrapped air in the coupling will be accomplished during pre-flight and/or installation checkout procedures (document # TBD) where bleeding will be accomplished through the entire galley water system.

3.2.1.12 Steam Sterilization

The galley water system shall be compatible to steam sterilization, as defined in the Pre-Flight/Installation Check Out Procedure (Document # TBD).

3.2.2 Galley Electrical System

3.2.2.1 Connector Configuration

The power sources and the telemetry circuits shall be connected to the galley electrical system with two separate connectors as depicted in Figure 3 and in accordance with 40M39569. (See note 6.2.1).

3.2.2.1.1 Shuttle Connectors

Both shuttle connectors shall be the flange mounted receptacle type with socket contacts.

3.2.2.1.2 Galley Connectors

Both galley connectors shall be plug type with pin contacts.

3.2.2.1.3 Contact Size

The pin/socket size for the power connector shall be #12. The pin/socket size for the telemetry connector shall be #20.

3.2.2.1.4 Total Contacts

The power connector shall have provision for 8 contacts. The telemetry connector shall have provision for 18 contacts. Both connector spare contact cavities shall be filled with sealing plugs. Figures 4 and 5 show the pin/wire assignments for the power and telemetry connectors respectively.

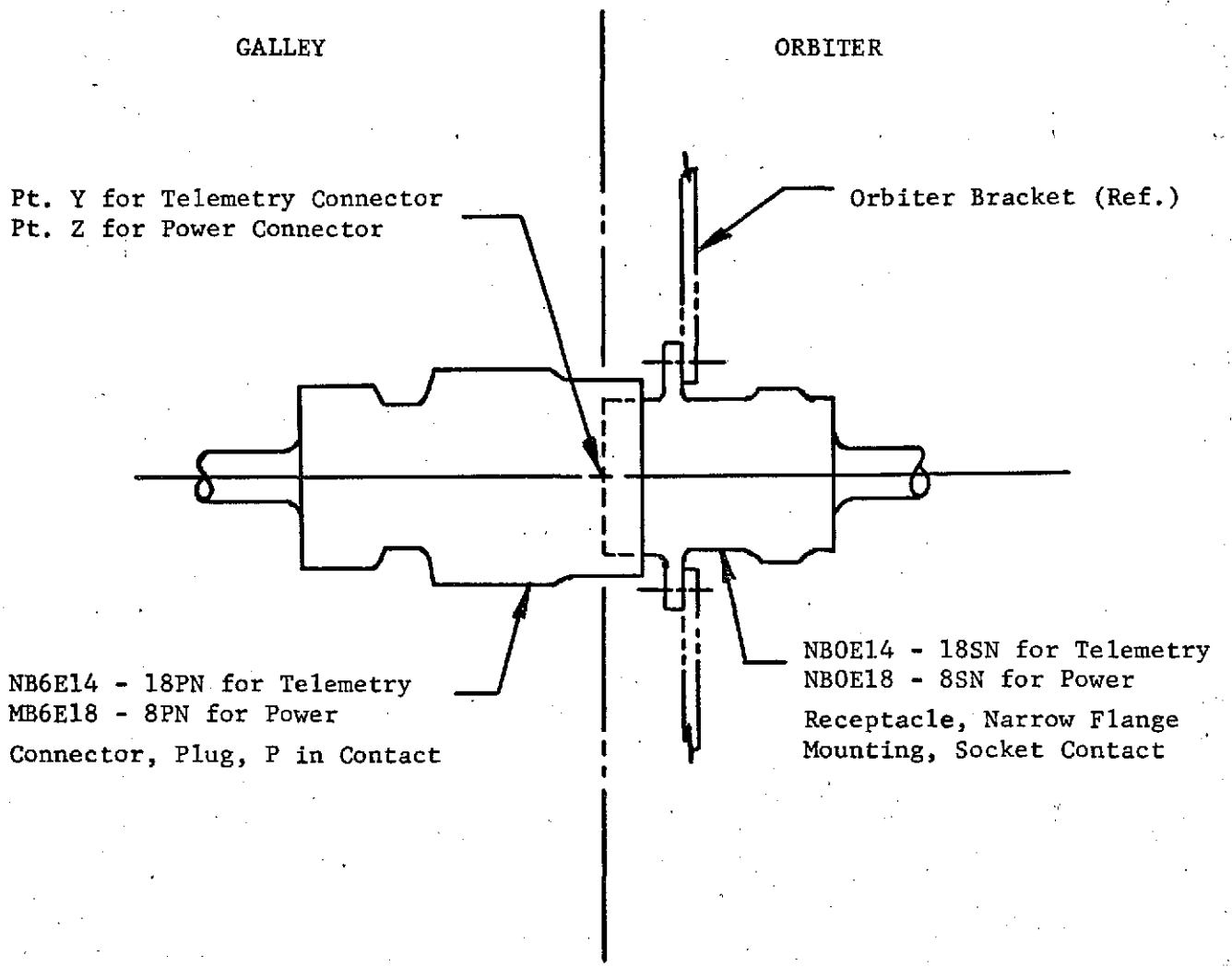


Figure 3. Galley/Orbiter Electrical Connections

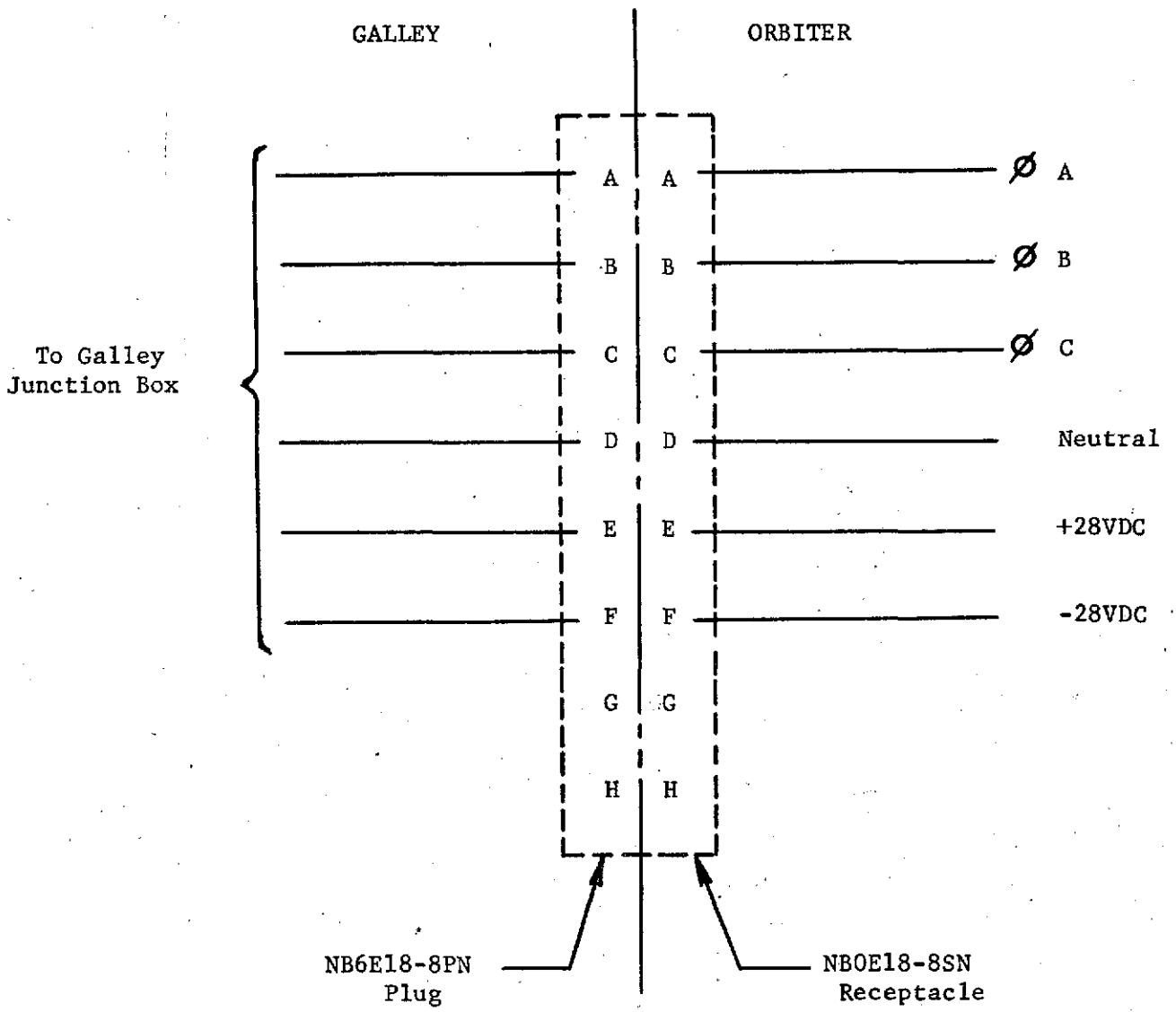


Figure 4. Power Connector Pin/Socket Assignments

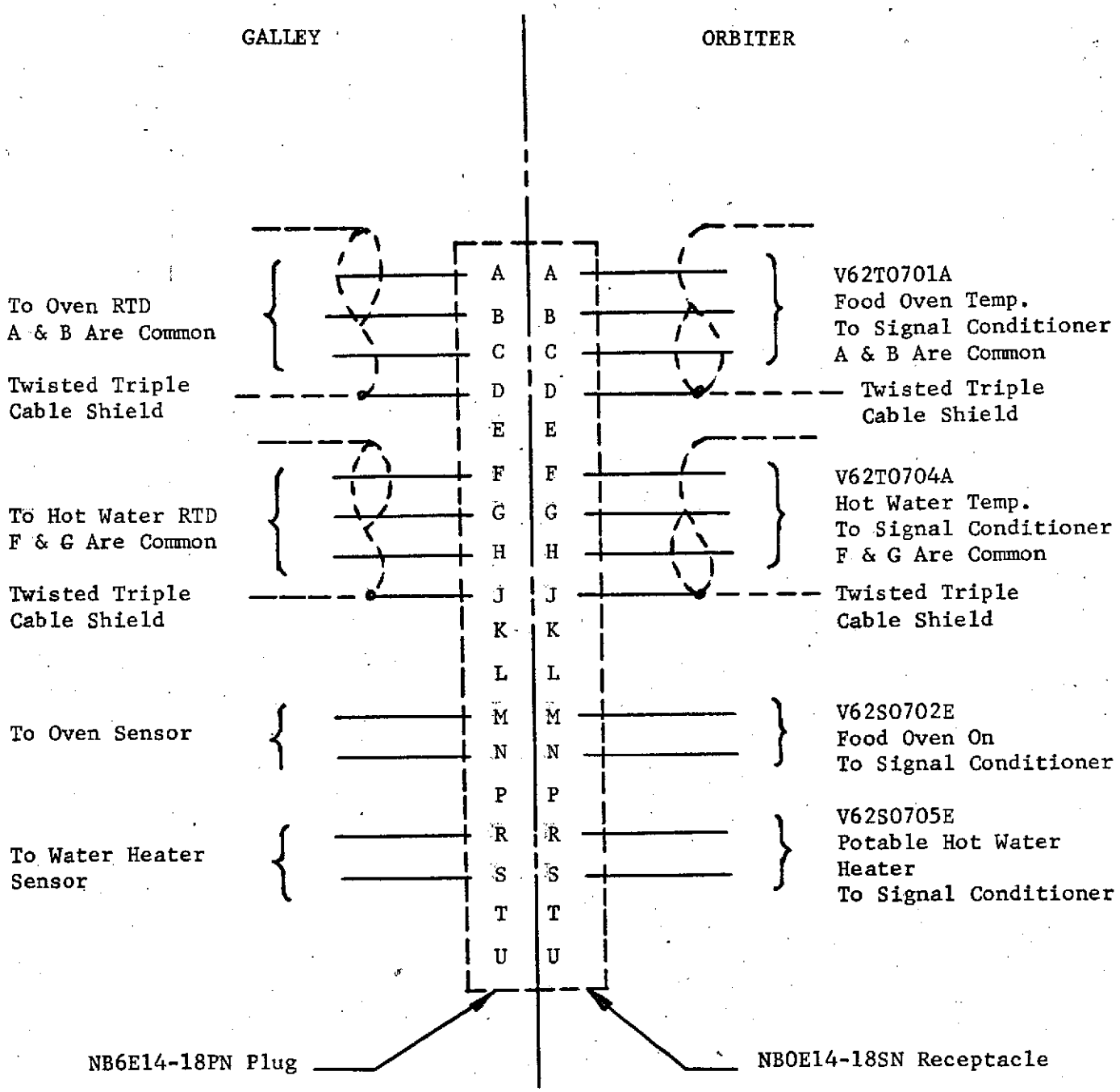


Figure 5. Telemetry Connector Pin/Socket Assignments

3.2.2.2 Interchangeability

The individual connectors shall be interchangeable such that replacement of one will not necessitate changing its mating connector.

3.2.2.3 Stress Relief

Stress relief devices shall be provided for the connectors.

3.2.2.4 Connector Caps

The connectors shall be provided with metal protective covers whenever they are not covered. The caps shall be brightly colored so as to be readily discernible.

3.2.2.5 Connector Arrangement

The galley connectors and cables shall have sufficient length and flexibility to permit simple connection and disconnection without damage to the connectors or cables.

3.2.2.6 Accessibility to Connector

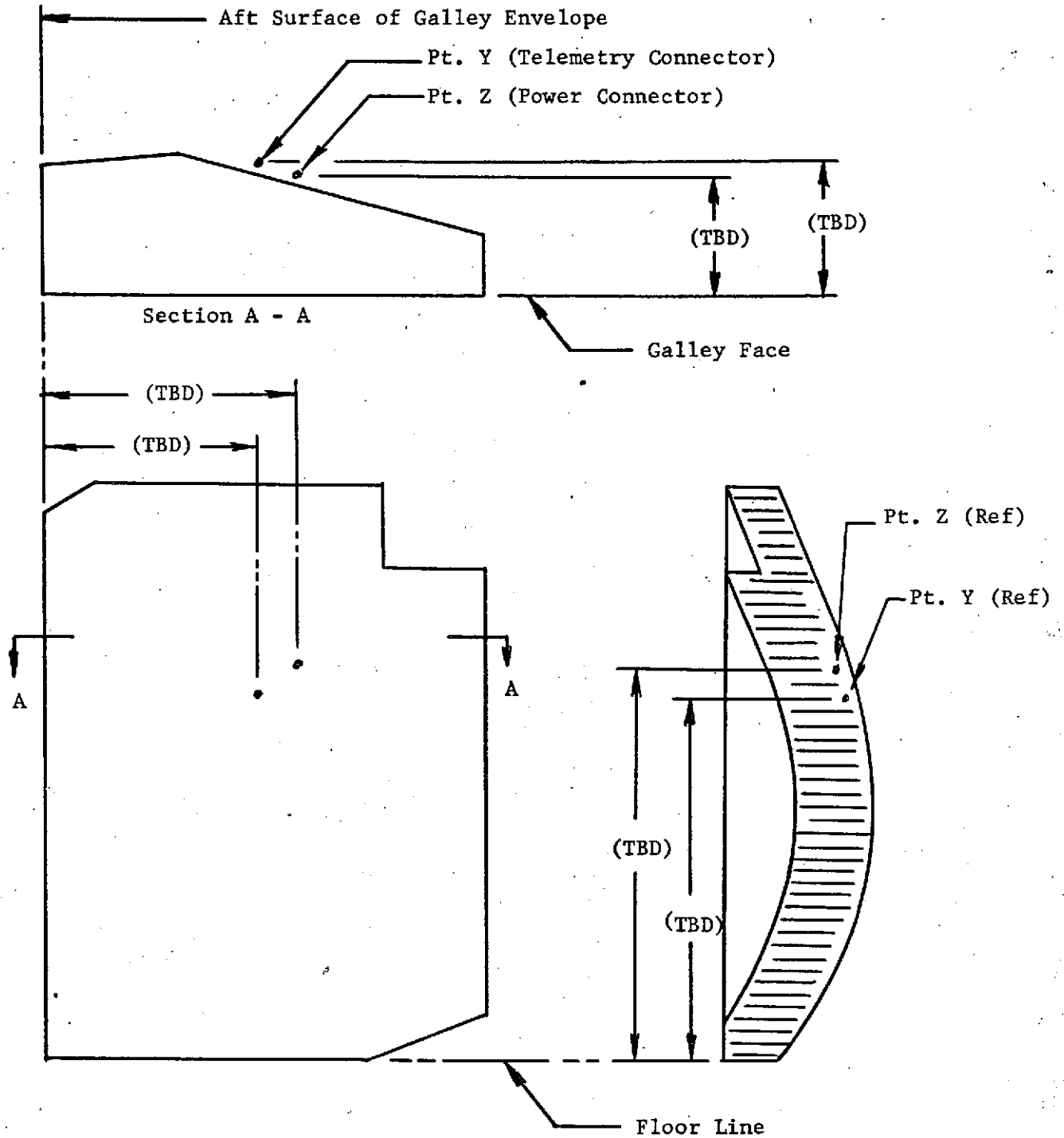
Provision shall be made for access to the connectors for ease of maintenance and visual verification of proper mating.

3.2.2.7 Location

The connectors shall be located as shown in Figure 6.

3.2.2.8 Keyway Orientation

The keyway orientation shall be facing either upward or forward depending on mounting position.



View Looking Outboard
at Galley Face

Figure 6. Location of Electrical Connections

3.2.2.9 Electrical Bonding

The receptacles shall have a low resistance bond to the orbiter structure not greater than 2.5 milliohms in accordance with MIL-B-5087 Class R.

3.2.3 Galley Structural System

3.2.3.1 Attaching Hardware

The attaching hardware and configuration used to make the structural connection between the galley and orbiter shall be as shown on Figure 7. The lower connection between the galley and orbiter shall be rigid and the upper connection shall allow relative movement, in the vertical direction, between the orbiter and galley structure. (See Note 6.3.1).

3.2.3.1.1 Attachment Envelope

The structural connection including the galley and orbiter mating structure and the hardware as in 3.2.3.2 shall be within the confines of the envelope as defined in Figure 8. (See Note 6.3.2).

3.2.3.1.2 Location

The galley attaching points shall be located as depicted in Figure 9, with coordinates, in terms of orbiter reference axis given in Table I. (See Note 6.3.3).

3.2.3.1.3 Access

Accessibility shall be provided to remove and install the attaching hardware without the use of universal joints, angular extensions, handle extensions, or combinations thereof, in conjunction with

TBD

Figure 7. Configuration of Attaching Hardware

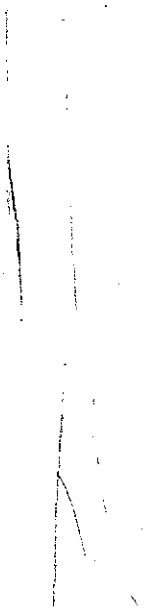


Figure 8. Attachment Envelope

P_t	X_o	Y_o	Z_o
A	TBD	TBD	TBD
B	TBD	TBD	TBD
C	TBD	TBD	TBD
D	TBD	TBD	TBD
E	TBD	TBD	TBD
F	TBD	TBD	TBD

TABLE I. Location of Attachments

Condition	Point / Axis	A	B	C	D	E	F
Launch	X Pos	TBD	TBD	TBD	TBD	TBD	TBD
	X Neg						
	Y Pos						
	Y Neg						
	Z Pos						
	Z Neg						
Landing	X Pos						
	X Neg						
	Y Pos						
	Y Neg						
	Z Pos						
	Z Neg						

TABLE II. Attachment Loads

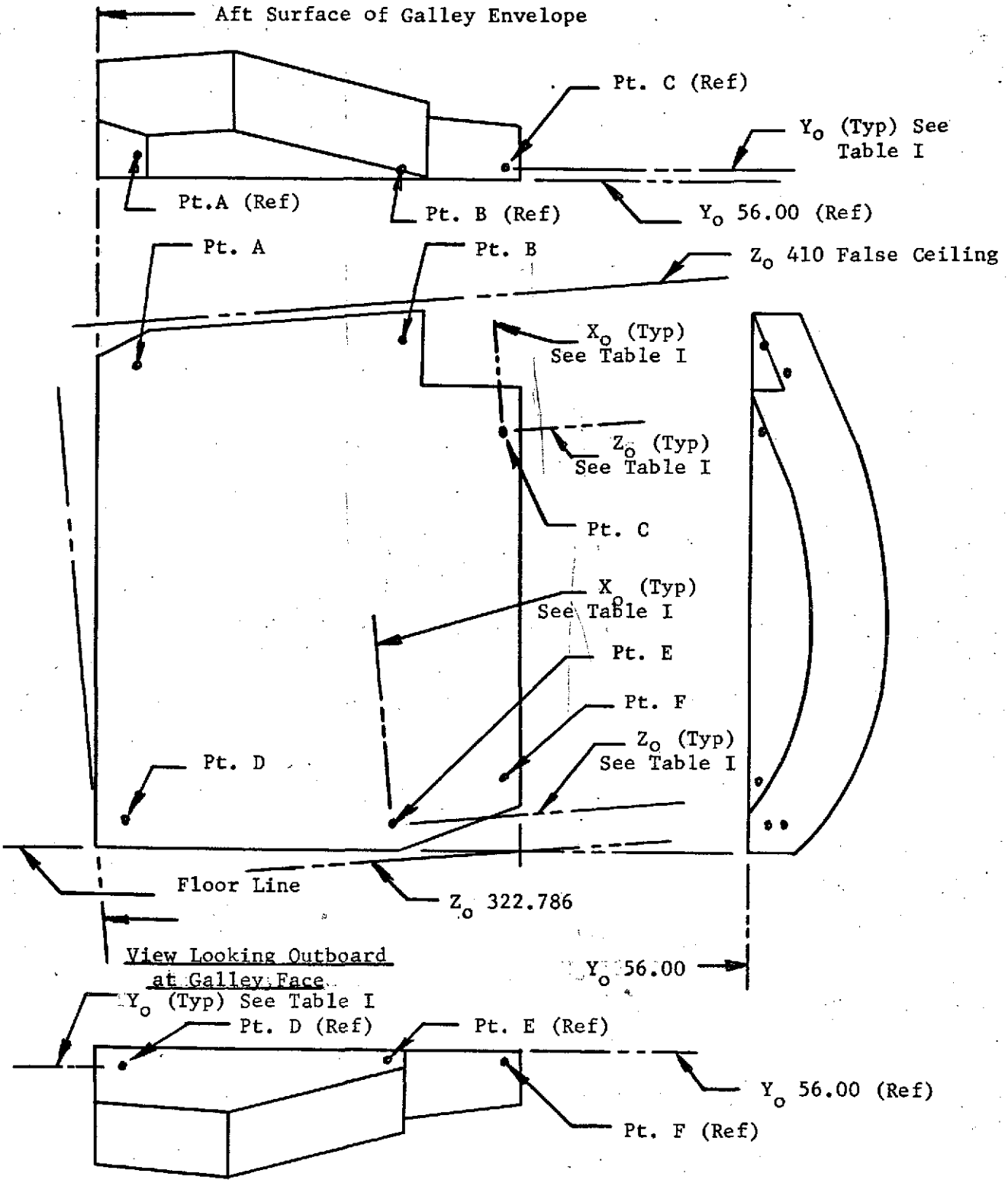


Figure 9. Location of Attachments

3.2.3.1.3 Access (cont')

torque tools while the galley is in the installed position within the orbiter. Visual verification of properly secured hardware shall also be provided.

3.2.3.1.4 Retention of Hardware

The attaching of hardware shall be positively retained to prevent loosening during service. The retention device shall not require lock wire.

3.2.3.1.5 Threads and Fasteners

Screw threads shall be in accordance with MIL-S-7742 or MIL-S-8879 for fastener ultimate tensile strengths below 160,000 pounds per square inch (psi). MIL-S-8879 shall be used for fastener ultimate tensile strengths of 160,000 psi or greater. External threads in accordance with MIL-S-8879 for fastener tensile strengths of 160,000 psi and greater shall be produced by a single thread-rolling process after final heat treat. (Exception to MIL-S-7742 and MIL-S-8879: the single element gaging procedures shall not be a requirement for acceptance, but will be used as a reference method when acceptability is questionable.)

3.2.3.1.6 Safety

Whenever the galley is not installed, the floor at the attachment points near the ingress-egress hatch shall be clear of any impediment that could present a hazard to personnel.

3.2.3.2 Mass Properties

The following properties are based on a galley with food stored for a seven man, six day mission.

3.2.3.2.1 Weight

The galley weight including the packaged food (rehydratables, RTE's and beverages, plus contingency food and condiments) shall be 426# maximum. (See Note 6.3.4).

3.2.3.2.2 Center of Gravity

The galley center of gravity shall be (TBD) and located within that range as shown in Figure 10.

3.2.3.2.3 Moment of Inertia

The galley moment of inertia shall be (TBD) and oriented as shown in Figure 10.

3.2.3.3 Interchangeability

The galley structural assembly shall be interchangeable with the orbiter such that any galley shall be able to be replaced with any other galley without any modification to the orbiter or galley structure or attaching hardware. The attaching hardware shall also be interchangeable so as to be able to be used for any galley installation.

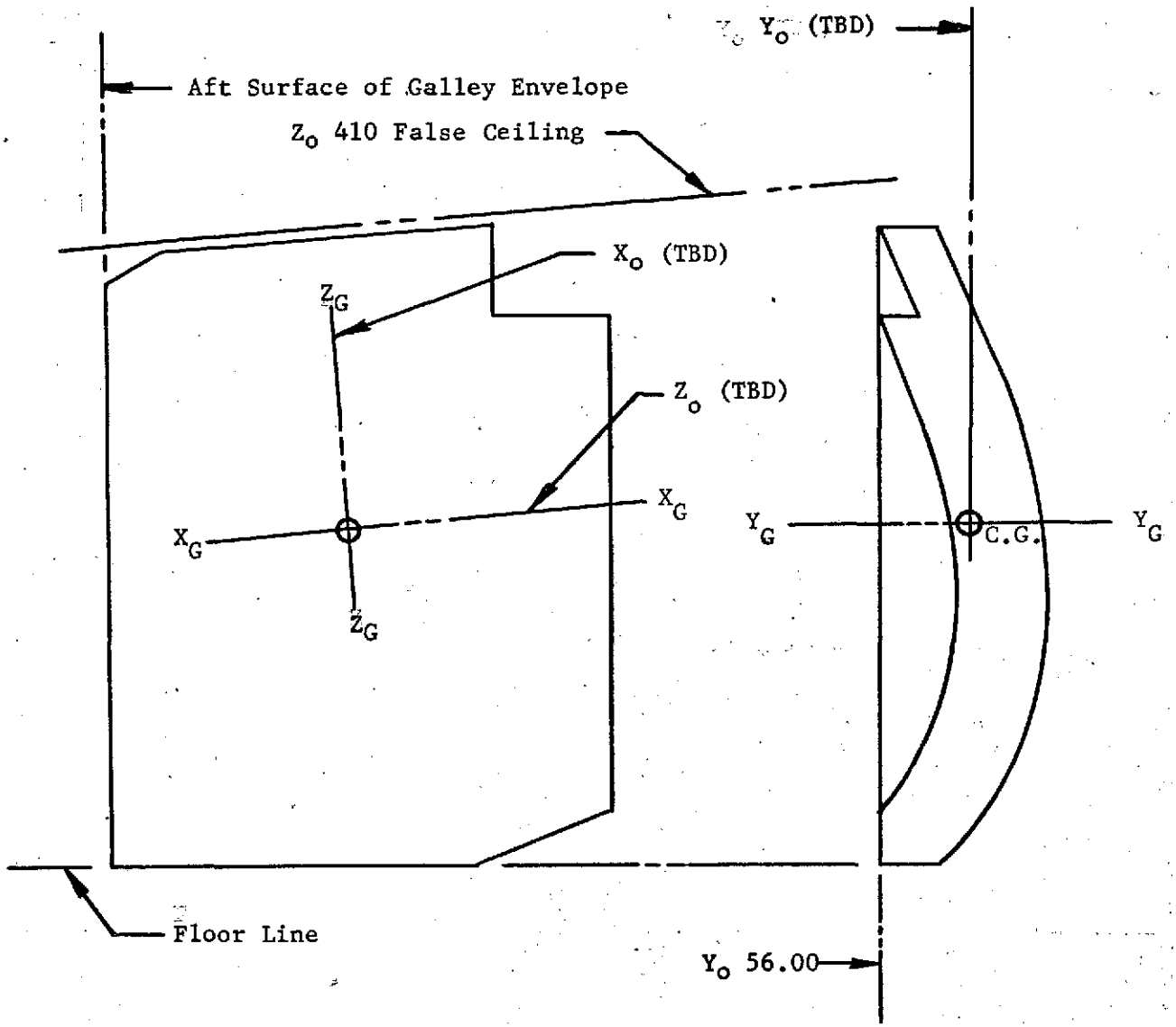


Figure 10. Center of Gravity and Moment of Inertia

3.2.3.4 Provision for Protective Device

The galley shall have provision for the installation of protective devices to be utilized during transportation through the hatch and maneuvering into position for installation. The protective device shall be configured as defined in (TBD Drawing #). The structural attachments of the orbiter and galley shall be suitably protected against any nicks or scratches on close tolerance surfaces.

3.2.3.5 Electrical Bonding

The galley structure shall be electrically bonded to the orbiter structure in accordance with MIL-B-5087 Class R.

3.3 Performance

3.3.1 Galley Water System

3.3.1.1 Water Quantities

The shuttle orbiter ambient and chilled water sources shall supply water within those functional requirements specified in 3.1.1 consistent with the demands of the galley water systems as defined in the following paragraphs.

3.3.1.1.1 Flow Demand

Continuous flow demands for the galley water system are dependent on the particular food/beverage package to be rehydrated and the number of packages involved at any one meal. There is also a requirement for drinks at any time between regular meals. Continuous flow demands should not exceed 8 ounces (max. requirement for any food/beverage package). Accumulative intermittent demand at maximum meal is as follows:

3.3.1.1.2 Maximum Meal Demand

The maximum meal demand results from the accumulated intermittent demands for the individual food/beverage packages required to make up a maximum meal for a seven man crew. In the event of a ten man crew it is anticipated that they will eat in shifts, and will not impact these flow demands. The accumulated time is that required from initial water dispensed to last water dispensed for that meal.

Ambient Water

Total quantity for meal	15.45#
Accumulated time for water demand	23.42 minutes

Chilled Water

Total quantity for meal	16.78#
Accumulated time for water demand	22.84 minutes

3.3.1.1.3 Daily Nominal Demand

The following specifies the total nominal daily demand for both ambient and chilled water systems for a seven man crew.

Ambient	22.71#
Chilled	18.07#

3.3.1.2 Environments

The couplings (3.2.1) as mounted in the installed configuration shall meet the functional and performance requirements of this document after being subject to the storage, checkout and flight environments (TBD Para. #'s) of the galley specification (TBD Document #).

3.3.2 Galley Electrical System

3.3.2.1 Power

The power available for the simultaneous operation of the galley semi-active oven, water heater, and instrumentation shall be a minimum of 2.0 kW AC and TBD kW DC. This power level allows for future growth of the galley.

3.3.2.2 Demand

3.3.2.2.1 Semi-Active Oven

The oven is normally utilized 3 times daily at meal preparation and occasionally for snacks. The power available shall be .150 kW AC for periods of 0.92 hours.

3.3.2.2.2 Water Heater

Hot water may be used at all three meals and two snack periods, and shall be available at any time in between. The water heater shall maintain the water temperature at 160°F. between uses. Hot water shall be available at a continuous flow rate of 60#/hr., for which the total water heater power usage shall be 1.85 kW AC.

3.3.2.2.3 Instrumentation

Panel lights are used to indicate the oven and heater operation for those functions and during those periods as indicated in 3.3.2.2.1 and 3.3.2.2.2. The nominal power shall be TBD kW DC.

3.3.2.3 Energy Requirements

The nominal daily power available shall be TBD kW hours AC and TBD kW hours DC.

3.3.3 Galley Structural System

3.3.3.1 Environment

The structural connections, with the galley in the installed configuration, shall sustain the launch, orbit, re-entry, landing and transportation and handling environments as defined in JSC-09070, paragraph 3.1.2.5 and 3.1.2.6 without any permanent deformation. The structural connection shall also sustain the crash environment defined in JSC-09070, paragraph 3.1.2.5 without failure.

3.3.3.1.1 Loads

The loads on each attachment shall be as specified in Table II. (See Note 6.3.5).

3.3.3.2 Life Requirements

The orbiter and galley structural connections, including the hardware, shall be capable of sustaining the operational environments of 3.3.3.1, launch, orbit, re-entry and landing for a minimum of 100 orbital missions. In addition, the connections shall be capable of sustaining the handling, transportation and storage environments associated with the removal and re-installation of the galley a minimum of (TBD) times.

3.3.3.3 Maintainability

The galley shall be capable of being removed and replaced on the orbiter within (TBD) hours.

3.3.3.4 Manufacturing Tolerances

The structural attachments shall be designed so as to allow for those manufacturing tolerances that would result in angular misalignment or a linear differential, thereby precluding any excessive stresses in the connection when the attachment is secured.

3.3.3.5 Operational Deflection

The linear and angular deflection at each attaching point that may occur under operating conditions shall be (TBD). The structural connection shall provide for these deflections without any excessive stresses in either the orbiter or galley to maintain the intent of 3.1.3.2.

3.3.3.6 Factor of Safety

A minimum factor of safety of 1.5 shall be maintained for the attaching structure and hardware.

3.4 Procedural

3.4.1 Galley Water System

In order to meet those functional and performance requirements of 3.1.1 and 3.2.1 the physical connecting of the water system couplings must be coordinated with the pre-flight, and/or installation check out procedures (Document # TBD) which should include, as a minimum, the following functional operations:

3.4.1 Galley Water System (cont'd)

a) A method of adding and pressurizing water in the mated water systems.

b) A method of flushing water through the galley dispensers and bleeding out all entrapped air in the combined water systems.

c) A connecting/disconnecting procedure.

d) A cleansing method and pre-flight verification procedure.

e) A method of steam sterilization of the galley water system.

3.4.2 Galley Electrical System

In order to meet those functional and performance requirements of 3.1.2 and 3.2.2 the physical attachment of the eletrical connectors must be coordinated with the pre-flight, and/or installation checkout procedures (Document # TBD).

3.4.3 Galley Structural System

The galley and attaching hardware installation shall be accomplished in accordance with (TBD Document #) "Galley Installation Procedure" and shall include, as a minimum, the installation and removal of the protective equipment used, the torque value for the attaching hardware, and the removal of any shipping restraints.

4.0 VERIFICATION

Each interface requirement listed in Section 3.0 shall be verified by either analysis, assessment, test, or a combination of these.

4.0 VERIFICATION (cont'd)

The specific method is given in the Verification Matrix, Table III, for the Galley Water, in Table IV for the Galley Electrical System, and in Table V, for the Galley Structural System.

5.0 PRESERVATION AND PACKING

5.1 Galley Water System

5.1.1 Mounting

Each coupling as mounted, before vehicle installation, shall be capable of systaining those handling and transportation environments as specified in (TBD Para. #) in the galley specification (TBD Document #) without degrading those interface requirements as stated in this document.

5.1.2 Installation

Each coupling shall have provisions for installation of a protective end cap, capable of maintaining a sterile environment immediately surrounding the mating portions of the coupling, while in the transportation and storage state.

5.2 Galley Electrical System

5.2.1 Environment

Each connector as mounted, before vehicle installation, shall be capable of sustaining those handling and transportation environments as specified in (TBD Para. #) in the galley specification (TBD Document #) without degrading those interface requirements as stated in this document.

Section 3 Requirements	Analy-sis	Assessment			Test	
		Similarity	Review of Design or Applicable Dwg.	Inspec-tion	Mock-up	First Unit Install. Check Out
3.1.1 Function						
3.1.1.1	X					
3.1.1.2	X					X
3.1.1.3	X					X
3.1.1.4	X					X
3.2.1 Physical						
3.2.1.1				X		
3.2.1.1.1			X			
3.2.1.1.2						X
3.2.1.1.3			X			
3.2.1.2				X		
3.2.1.3			X	X		
3.2.1.4	X				X	X
3.2.1.5			X	X		
3.2.1.6			X	X		
3.2.1.7			X			
3.2.1.8			X			X
3.2.1.9			X		X	X
3.2.1.10			X	X		
3.2.1.11						X
3.2.1.12			X			
3.3.1 Performance						
3.3.1.1						
3.3.1.1.1	X					X
3.3.1.1.2	X					
3.3.1.1.3	X					
3.3.1.2	X	X				
3.4.1 Procedural						X

TABLE III Verification Matrix
Galley Water System

Section 3 Requirements	Analysis	Assessment			Test	
		Similarity	Review of Design or Applicable Dwg.	Inspection	Mock-up	First Unit Install. Check Out
3.1.2 Functional			X			X
3.1.2.1						X
3.1.2.2						X
3.1.2.3		X				
3.1.2.4						X
3.1.2.5			X			X
3.1.2.5.1			X			
3.2.2 Physical						
3.2.2.1			X	X		
3.2.2.1.1			X	X		
3.2.2.1.2			X	X		
3.2.2.1.3			X			
3.2.2.1.4			X	X		
3.2.2.2			X			
3.2.2.3			X	X		
3.2.2.4				X		
3.2.2.5				X	X	
3.2.2.6				X	X	
3.2.2.7			X	X		
3.2.2.8				X		
3.2.2.9			X			X
3.3.2 Performance						
3.3.2.1			X			
3.3.2.2.1			X			X
3.3.2.2.2			X			X
3.3.2.2.3			X			X
3.3.2.3			X			X
3.4.2 Procedural						X

TABLE IV Verification Matrix
Galley Electrical System

Section 3 Requirements	Analy-sis	Assessment			Test	
		Similarity	Review of Design or Applicable Dwg.	Inspec-tion	Mock-up	First Unit Install. Check Out
3.1.3 Functional						
3.1.3.1	X					
3.1.3.2	X					
3.1.3.3			X		X	
3.1.3.4			X		X	
3.2.3 Physical						
3.2.3.1			X			X
3.2.3.1.1			X			X
3.2.3.1.2			X	X		
3.2.3.1.3			X		X	
3.2.3.1.4		X	X			
3.2.3.1.5			X	X		
3.2.3.2			X			
3.2.3.2.1	X			X		
3.2.3.2.2	X					
3.2.3.2.3	X					
3.2.3.3			X			
3.2.3.4			X	X		
3.2.3.5			X			X
3.3.3 Performance						
3.3.3.1	X					
3.3.3.1.1	X					
3.3.3.2	X					
3.3.3.3					X	X
3.3.3.4	X		X			
3.3.3.5	X					
3.3.3.6	X					
3.3.4 Procedural				X		X

TABLE V. Verification Matrix
Galley Structural System

5.2.2 Protective Cap

Each connector shall have provisions for installation of a metal protective end cap, Ref. 3.2.2.4, while in transportation and during storage.

5.3 Galley Structural System

5.3.1 Ground Handling and Transportation

The galley structural connections shall have the capability to withstand those loads and environments of the ground handling and transportation paragraphs 3.1.2.5 and 3.1.2.6 in the galley specification JSC-09070 without any deformation or surface damage, with the galley supported in the packing case by its structural attachments.

6.0 NOTES

6.1 Galley Water System

6.1.1 Procurement of Interface Couplings

The (TBD) quick disconnect couplings shall be procured and qualified by the galley contractor. Those couplings that are part of the orbiter shall be supplied to the orbiter contractor for installation and shall then become part of the orbiter side of the interface.

6.2 Galley Electrical System

6.2.1 Procurement of Connectors

The connectors for both the galley and orbiter vehicle (3.2.2.1) shall be procured and qualified by the galley contractor. Those

6.2.1 Procurement of Connectors (cont'd)

connectors that are part of the orbiter shall be supplied to the orbiter contractor for installation and shall then become part of the orbiter side of the interface.

6.3 Galley Structural System

6.3.1. Configuration and Hardware Specifications

Configuration and hardware specifications shall be determined by the galley contractor. The definition of points A, B, C, etc., per 3.2.3.1.2, shall be shown in Figure 7 relative to a reference common to both the orbiter and galley structure.

6.3.2 Attachment Envelope

The attachment envelope shall be determined by the galley contractor and shall include the detailed dimensions, including tolerances, of each interfacing component of the attachment.

6.3.3 Attachment Locations

The actual number and location of the attachments shall be determined by the galley contractor. The points A, B, C, etc., are specified in Figure 9 as an example of locating the attachments and shall be defined with the configuration to be shown in Figure 7. The location of the attachments shall be within the galley envelope as specified in 3.1.3.3 and near the top and bottom portions of the envelope to conform with the orbiter contractors intent to build up the interfacing attachment structure from below the floor and above the ceiling.

6.3.4 Galley Weights

Preliminary estimates indicate that the galley weight, without food, should not exceed 266#.

6.3.5 Attachment Loads

Loads for each attachment shall be determined by the galley contractor for subsequent inclusion in this document. Each condition and associated accelerations from 3.3.3.1 environments shall be tabulated with the resulting loads defined in a three axis reference.